

# ATA Command Extension Proposal for Media Card Pass Through Command

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## Introduction:

Recently, the small-format flash memory cards, such as the Secure Digital (SD) Card, the Multi-media Card (MMC), and the Sony Memory Stick, have achieved wide consumer acceptance. These devices are primarily designed for consumer electronic devices such as digital cameras and flash-memory music players. However, it is desirable that they also have convenient connections to personal computers for uploading and downloading data.

The different cards have different electrical interfaces. This proposal defines commands that a hardware adapter could use to adapt these cards to an ATA-style interface. All cards have unique functions such as special I/O and security that are useful to expose to the PC host. To keep the adapter simple and inexpensive, the philosophy is to simply encapsulate the underlying card commands within a few ATA commands.

The founders of the SD Card association, MEI, Toshiba, and SanDisk are putting this proposal forward. Nonetheless, it is intended to be generic for all small-format cards, not just SD Cards.

## Proposed Changes

The follows additions/modification are proposed for the ATA/ATAPI-~~67~~ standard based on the ATA/ATAPI-~~67~~ rev 1a0 draft standard:

**X. x Media Card Pass Through Command feature set:**



The **Media Card Pass Through Command** feature set uses the reserved commands “D1”, “D2”, “D3” and “D4”, in addition to words 83 and 86 of the IDENTIFY DEVICE response. The commands “D2”-“D4” are reserved for the **Media Card Pass Through Command** feature set if this feature set is enabled by the command “D1”. If the feature set is disabled, the commands “D2”-“D4” will be interpreted differently. The detailed information is described in the “D1” command of this proposal. This feature set embeds a small-format flash memory card commands inside the ATA commands. The adapter’s firmware passes the embedded memory card’s command to the memory card as is from the ATA command. The **PASS THROUGH** feature reduces the number of commands required for this feature set regardless of the number or type of memory card commands. It also reduces the adapter’s firmware overhead in processing them. As new memory cards types are defined in the market, they can all be supported within this one feature.

The **Media Card Pass Through Command** feature set has total of 4 commands.

**Check Media Card Type (Command Code D1h)**

**Media Card Header command (Command Code D2h)**

**Media Card Execute command (Command Code D3h)**

**Media Card Retrieve Response command (Command Code D4h)**

The **Check Media Card Type command** returns the supporting status of the device to this feature set. It also enables and disables the device from running the Media Card Pass Through command mode. When the Media Card Pass Through command mode is disabled, the command codes D2-D4 will not be interpreted as Media Card Pass Through commands. Sending a native command to the underlying memory card is done in two steps. In the first step, the **Media Card Header command** sends the first parameters to the underlying native command. In the second step, the **Media Card Execute command**, remaining parameters are sent and the native command is actually executed. The Media Card **Retrieve Response command** reads the underlying card’s specific response.



In clause 8

## 8.12 IDENTIFY DEVICE

**Table - - IDENTIFY DEVICE information ( Word 50, 83 and 86)**

Word	F/V	
83	F	9: 1 = Media Card Pass Through command supported
86	V	9: 1 = Media Card Pass Through command enabled

F = The content of the word is fixed and does not change. For removable media devices, these values may change when media is removed or changed.

V = The contents of the word is variable and may change depending on the state of the device or the commands executed by the device.

## 8.x MEDIA CARD PASS THROUGH COMMAND Feature Set

### 8.x.1 CHECK MEDIA CARD TYPE command

#### 8.x.1.1 Command code

D1h

#### 8.x.1.2 Feature set

- Mandatory when the Media Card Pass Through Command feature set is implemented

#### 8.x.1.3 Protocol

Non-data command

#### 8.x.1.4 Inputs



Register	7	6	5	4	3	2	1	0
Feature	na							ENB
Sector Count	na							
Sector Number	na							
Cylinder Low	na							
Cylinder High	na							
Device/Head	obs	na	obs	DEV	na			
Command	1	0	1	1	0	0	0	1

Feature register –

ENB = 1 to enable the Media Card Pass Through mode; = 0 to disable it.

Note: After the power on state (Hard Reset) or Software Reset, this Value of Bit 9 Word 86 of IDENTIFY DEVICE data is set to “0” as an initial Value. To enable the Media Card Pass Through mode, this command must be sent with ENB bit setting to 1.

Feature register –

ENB = 1 to enable the Media Card Pass Through mode; = 0 to disable it.

## Device/Head register –

DEV shall indicate the selected device

**8.x.1.5 Normal Outputs**

For **Media Card adapter supporting the pass through command**, the status register outputs are describes as below. In addition, the device should return 55H in Sector Count Register and AAH in Sector Number register. The Device/Head register should remain the same as input for the selected device. If the adapter supports the Media Card Pass Through feature set and the ENB bit of the feature register input is set to 1, it must process any further Media Card Pass Through commands from now on. If the ENB bit is set to 0, the adapter must not interpret the command codes D2-D4 as the Media Card Pass Through commands. If the adapter does not support Media Card Pass Through Command set, or the host has disabled the Media Card Pass Through mode by setting ENB to 0, the host shall not send any further Media Card Pass Through command to the adapter.

Register	7	6	5	4	3	2	1	0
Error	0	0	0	0	0	0	0	0
Sector Count	0	1	0	1	0	1	0	1
Sector Number	1	0	1	0	1	0	1	0
Cylinder Low	d0							
Cylinder High	d1							
Device/Head	obs	na	Obs	DEV	WP	Media Type		
Status	BSY	DRDY	DF	1	DRQ	0	0	ERR

## Status register – 50H



BSY shall be cleared to zero indicating command completion.

DRDY shall be set to one.

DF (Device Fault) shall be cleared to zero.

DRQ shall be cleared to zero.

ERR shall be cleared to zero.

Device/Head register –

DEV shall indicate the selected device

WP                    1: Write Protect, 0: No Write Protect

Media Type    001: SD Memory Card

                  010: MMC

                  011: SD IO Card

                  000, 100~111: Reserved

Cylinder High register – card-specific data d1 (RCA bits 24-31)

Cylinder Low register – card-specific data d0 (RCA bits 16-23)

Sector Number register - AAH

Sector Count register – 55H



### 8.x.1.6 Error Outputs

If there is an error in processing this command, the device shall set Error Bit in the Status register and set ABRT bit in the Error register.

Register	7	6	5	4	3	2	1	0
Error	0	0	0	0	0	ABRT	0	0
Sector Count	na							
Sector Number	na							
Cylinder Low	na							
Cylinder High	na							
Device/Head	obs	na	obs	DEV	na			
Status	BSY	DRDY	DF	na	DRQ	na	na	ERR

Device/Head register –

DEV shall indicate the selected device

Status register:ERR (B0) shall be set to 1 to indicate error occurred

BSY shall be cleared to zero indicating command completion.

DRDY shall be set to one.

DF (Device Fault) shall be set to one if a device fault has occurred.

DRQ shall be cleared to zero.

ERR shall be set to one if an Error register bit is set to one.

Error register: ABRT (B2) shall be set to 1 to indicate command aborted

### 8.x.1.7 Description

This **CHECK MEDIA CARD TYPE** command allows the host to determine the device's capability of supporting the **ATA Media Card Pass Through Command** feature set. The Identify Drive Data bit 9 of Word 86 should be set to 1 upon the successful completion of this command.



## 8.x.2 MEDIA CARD HEADER command

### 8.x.2.1 Command code

D2h

### 8.x.2.2 Feature set

- Mandatory when the Media Card Pass Through Command feature set is implemented
- This command must precede the **MEDIA CARD EXECUTE command**.

### 8.x.2.3 Protocol

Non-data command

### 8.x.2.4 Inputs

Register	7	6	5	4	3	2	1	0
Feature	Command Argument 4 (B15:8)							
Sector Count	Command Argument 3 (B23:16)							
Sector Number	Command Argument 2 (B31:24)							
Cylinder Low	Command Argument 1 (B39:32)							
Cylinder High	0	APP	Command Index (B45:40)					
Device/Head	obs	na	obs	DEV	Response Type			
Command	1	0	1	1	0	0	1	0

Command register – “D2h”

Cylinder High -

APP shall indicate the command type; 0 = Normal Command, 1 = Application Command

Device/Head register –

DEV shall indicate the selected device.

Response Type shall indicate the response type of the underlying native command.

The remaining registers embed parameters to the underlying native command.

### 8.x.2.5 Normal Outputs



For the **MEDIA CARD ADAPTER supporting pass through** command set, the status register outputs are describes as below.

The Device/Head register should remain the same as input for the selected device.

Register	7	6	5	4	3	2	1	0
Error	0							
Sector Count	na							
Sector Number	na							
Cylinder Low	na							
Cylinder High	na							
Device/Head	obs	na	obs	DEV	Response Type			
Status	BSY	DRDY	DF	na	DRQ	na	na	ERR

Device/Head register –

Remains the same as input register

Status register – 50H

BSY shall be cleared to zero indicating command completion.

DRDY shall be set to one.

DF (Device Fault) shall be cleared to zero.

DRQ shall be cleared to zero.

ERR shall be cleared to zero.



### 8.x.2.6 Error Outputs

If there is error to process command, the device shall be set Error Bit in the Status register and set ABRT bit in the Error register.

Register	7	6	5	4	3	2	1	0
Error	0	0	0	0	0	ABRT	0	0
Sector Count	na							
Sector Number	na							
Cylinder Low	na							
Cylinder High	na							
Device/Head	obs	na	obs	DEV	na			
Status	BSY	DRDY	DF	na	DRQ	na	na	ERR

Device/ Head register –

DEV shall indicate the selected device

Status register:ERR (B0) shall be set to 1 to indicate error occurred

BSY shall be cleared to zero indicating command completion.

DRDY shall be set to one.

DF (Device Fault) shall be set to one if a device fault has occurred.

DRQ shall be cleared to zero.

ERR shall be set to one if an Error register bit is set to one.

Error register: ABRT (B2) shall be set to 1 to indicate command aborted

### 8.x.2.7 Description

This **MEDIA CARD HEADER command** sends the header part of the native command to be embedded inside the ATA command. The device shall return status ready with no error or status error with ABRT condition in Error register back to the host. If the status indicates success with no error, the host can proceed to send the **MEDIA CARD EXECUTE command** to the device.



## 8.x.3 MEDIA CARD EXECUTE command

### 8.x.3.1 Command code

D3h

### 8.x.3.2 Feature set

- Mandatory when the Media Card Pass Through Command feature set is implemented
- This command is identified by the value placed in the Feature register.
- This command must follow **MEDIA CARD HEADER command** immediately.

### 8.x.3.3 Protocol

Non-data, PIO data-in or data-out command depends on the embedded SD command

Feature Register D0h: Non-data command  
 D1h: PIO data-in command  
 D2h: PIO data-out command  
 00h - CFh, D3h - FFh: Reserved

### 8.x.3.4 Inputs

Register	7	6	5	4	3	2	1	0
Feature	Sub Command							
Sector Count	Data Transfer Length (LSB)							
Sector Number	Data Transfer Length (Middle Byte)							
Cylinder Low	Data Transfer Length (MSB)							
Cylinder High	CRC							0
Device/Head	obs	na	obs	DEV	DATA	BLKH	0	DIR
Command	1	0	1	1	0	0	1	1

Feature register – Sub command

Sub Command	Protocol	DATA	DIR
D0h	Non-data command	0	0 or 1
D1h	PIO data-in command	1	0
D2h	PIO data-out command	1	1



Command register – “D3h”

Device/Head register –

DEV shall indicate the selected device.

DATA shall indicate if this command requests data transfer; 0 = no data transfer, 1 = with data transfer

BLKH shall indicate the data transfer mode to the host or to the underlying card; 0 = single sector transfer, 1 = multiple sector transfer

DIR shall indicate the direction of the data transfer; 0 = read from the card, 1 = write to the card

Cylinder High register –

CRC: This field is set to ‘0’.

Cylinder Low register – contains the MSB of the data transfer length if data transfer is requested

Sector Number register – contains the middle byte of the data transfer length if data transfer is requested

Sector Count register – contains the LSB of the data transfer length if data transfer is requested

### 8.x.3.5 Normal Outputs

The success of the preceded **MEDIA CARD HEADER command** is required. When a data transfer is requested in the embedded native command, the data transfer protocol to the host should comply with the **ATA-7 standard**. **If the bit BLKH is set to 0, the data are transferred in single sector mode. The data transfer protocol should comply with the READ SECTOR or WRITE SECTOR command.** Otherwise it should comply with the **READ MULTIPLE or WRITE MULTIPLE commands**. If the data transfer size does not result into a sector boundary, the transfer protocol should be treated as a single sector transfer. The data transfer protocol is card-specific.

Multiple sector size is set with the SET MULTIPLE MODE command (C6h).



Register	7	6	5	4	3	2	1	0
Error	0							
Sector Count	Response bit 15-8							
Sector Number	Response bit 23-16							
Cylinder Low	Response bit 31-24							
Cylinder High	Response bit 39-32							
Device/Head	obs	na	obs	DEV	na			
Status	BSY	DRDY	DF	na	DRQ	na	na	ERR

#### Status register – 50H

BSY shall be cleared to zero indicating command completion.

DRDY shall be set to one.

DF (Device Fault) shall be cleared to zero.

DRQ shall be cleared to zero.

ERR shall be cleared to zero.

#### Device/Head register –

DEV shall indicate the device

Cylinder High register – Response bit 39-32

Cylinder Low register – Response bit 31-24

Sector Number register – Response bit 23-16

Sector Count register – Response bit 15-8

### 8.x.3.6 Error Outputs

If there is error to process command, the device shall be set Error Bit in the Status register and set proper bits in the Error register.

Register	7	6	5	4	3	2	1	0
Error	na	UNC	MC	na	MCR	ABRT	NM	na
Sector Count	na							
Sector Number	na							
Cylinder Low	na							
Cylinder High	na							
Device/Head	obs	na	obs	DEV	na			
Status	BSY	DRDY	DF	na	DRQ	na	na	ERR



Device/Head register –

DEV shall indicate the selected device

Status register:ERR (B0) shall be set to 1 to indicate error occurred

BSY shall be cleared to zero indicating command completion.

DRDY shall be set to one.

DF (Device Fault) shall be set to one if a device fault has occurred.

DRQ shall be cleared to zero.

ERR shall be set to one if an Error register bit is set to one.

Cylinder High register – Response bit 39-32

Cylinder Low register – Response bit 31-24

Sector Number register – Response bit 23-16

Sector Count register – Response bit 15-8

Error register:

UNC shall be set to 1 if the card has an underlying data error.

MC shall be set to 1 if the card has been changed since the last issuance of a command

MCR shall be set to 1 if the SD card has detected a media change request. This bit can only be cleared by the next SD card access command.

ABRT (B2) shall be set to 1 to indicate that command is aborted because this command is not supported, a **MEDIA CARD HEADER command** is not preceded or the command execution is not completed.

NM shall be set to 1 if no media is present in a removable media device.

### 8.x.3.7 Description

This **MEDIA CARD EXECUTE command** must follow the **MEDIA CARD HEADER command**. If there is other command entering between them, that command should be executed. For example, such command may come from BIOS. The **MEDIA CARD EXECUTE command** following it will be aborted. The “ERR” bit in STATUS REGISTER and the “ABRT” bit in ERROR REGISTER are both set to 1.

This **MEDIA CARD EXECUTE command** starts the execution of the native command embedded inside the ATA command. The device shall send the native command to the card, then receives response. If the command is to retrieve data from the underlying card, the adapter will read data from the card and transfer to the host. If the adapter does not have buffer to take all data required in the current command, it will read partial data from the card and transfer it to the host. This procedure is repeated until all data are transferred. If the command is to write data to the underlying card, the adapter will read data from the host and transfer to the card. If the adapter does not have buffer to



take all data required in the current command, it will read partial data from the host and transfer it to the card. This procedure is repeated until all data are transferred.

The adapter should save the response of the command in case the host wants to retrieve this information using “MEDIA CARD RETRIEVE RESPONSE” command for debugging purposes.



## 8.x.4 MEDIA CARD RETRIEVE RESPONSE command

### 8.x.4.1 Command code

D4h

### 8.x.4.2 Feature set

- Mandatory when the Media Card Pass Through Command feature set is implemented.

### 8.x.4.3 Protocol

Data input command

### 8.x.4.4 Inputs

Register	7	6	5	4	3	2	1	0
Feature	na							
Sector Count	Response length							
Sector Number	na							
Cylinder Low	na							
Cylinder High	na							
Device/Head	obs	na	obs	DEV	na			
Command	1	0	1	1	0	1	0	0

Device/Head register –

DEV shall indicate the selected device

Cylinder High register – Length of response of the previous command

### 8.x.4.5 Normal Outputs

If the device supports the **MEDIA CARD PASS THROUGH** command set, it shall return the response data following the **ATA-7** data transfer protocol. The number of data transfer bytes is specified by the Sector Count register. If odd number is set for the number of data transfer bytes at the word transfer, the remaining byte data will be set to 0.



Register	7	6	5	4	3	2	1	0
Error	0	0	0	0	0	0	0	0
Sector Count	Response Data transferred in bytes							
Sector Number	na							
Cylinder Low	na							
Cylinder High	na							
Device/Head	obs	na	obs	DEV	na			
Status	BSY	DRDY	DF	na	DRQ	na	na	ERR

Status register – 50H after the completion of transfer

BSY shall be cleared to zero indicating command completion.

DRDY shall be set to one.

DF (Device Fault) shall be cleared to zero.

DRQ shall be cleared to zero.

ERR shall be cleared to zero.

Device/Head register –

DEV shall indicate the selected device

Sector Count register – Number of bytes transferred

#### 8.x.4.6 Error Outputs

If there is an error in processing this command, the device shall set Error Bit in the Status register and set ABRT bit in the Error register.

Register	7	6	5	4	3	2	1	0
Error	0	0	0	0	0	ABRT	0	0
Sector Count	na							
Sector Number	na							
Cylinder Low	na							
Cylinder High	na							
Device/Head	obs	na	obs	DEV	na			
Status	BSY	DRDY	DF	na	DRQ	na	na	ERR



Device/Head register –

DEV shall indicate the selected device

Status register:ERR (B0) shall be set to 1 to indicate error occurred

BSY shall be cleared to zero indicating command completion.

DRDY shall be set to one.

DF (Device Fault) shall be set to one if a device fault has occurred.

DRQ shall be cleared to zero.

ERR shall be set to one if an Error register bit is set to one.

Error register: ABRT (B2) shall be set to 1 to indicate command aborted

#### 8.x.4.7 Description

The **MEDIA CARD RETRIEVE RESPONSE command** allows the host to retrieve the response data of the previous **MEDIA CARD PASS THROUGH** command.

Word	48bit Response	136bit Response	
0	Response bit 15-0	Response bit 15-0	
1	Response bit 31-16	Response bit 31-16	
2	Response bit 47-32	Response bit 47-32	
3	Reserved (00)	Response bit 63-48	
4	Reserved (00)	Response bit 79-64	
5	Reserved (00)	Response bit 95-80	
6	Reserved (00)	Response bit 111-96	
7	Reserved (00)	Response bit 127-112	
8	Reserved (00)	00000000	Response bit 135-128
9-255	Reserved (00)	Reserved (00)	